TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 251

THE EFFECT OF TUBE LENGTH UPON THE RECORDED PRESSURES FROM A PAIR OF STATIC ORIFICES IN A WING PANEL

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This investigation was instituted to determine the effect of tubing length upon the indicated pressure values as ascertained in the pressure distribution measurements upon the PW-9. The purpose is to determine the percentage of error in the pressure readings which might be caused by various lengths of tubing between the pressure orifices and the pressure cell at the manometer.

Measurements show that the shortest distance between an orifice and its corresponding pressure cell on the PW-9 airplane is 4 ft. 9 in., this orifice being No.4 U.R. which is located on the upper surface of the right upper wing panel adjacent to the center section strut fittings. The longest distance, 18 feet, is between the outermost and rearmost orifice in the left elevator and its corresponding pressure cell.

Equipment and Installation

In order to simulate the conditions which will be found in the pressure distribution investigation on the PW-9 in a quick and convenient manner, pressure pads of the type employed in

the pressure distribution investigation on the Los Angeles were installed on the upper and lower surfaces of the lower right wing panel of a JNS-1 airplane. The positions of these pads were 32 in. out from the fuselage and 30% of the chord back from the entering edge. These pressure openings were connected directly to one pressure cell on a recording instrument through a tubing length of 5 ft. Into these direct lines a narrow Y was introduced which permitted a second pressure line to be carried to a second pressure cell on the same recording instrument through three different lengths of tubing: 15, 25 and 50 ft. This tubing was installed in the rear of the fuselage with as few turns as possible and these of a relatively large radius.

Method of Tests

The pressure orifices were installed in a position which previous experience had demonstrated to have a rapid change in pressure in the maneuver of pulling out of a dive. An air speed of 90 miles per hour provided a satisfactory dynamic pressure for the air cells as used. A number of flights were made with each of the lengths of tubing above indicated, i.e.: 5' and 15', 5' and 25', and 5' and 50'. In all these flights glides with power off were made from an altitude of about 1200 feet, at a 90-mile air speed. Pull-ups were made of different values of acceleration and ranging from a very gentle flattening out to the most abrupt pull-up that it was possible to effect, and records

were taken on the double capsule recording instrument. Specimens of these records are attached.

Results

The following table gives results from one run with each of the tubing lengths noted above. Records were selected in which it is certain that no errors are introduced by defective instrument operation or leaking tubing.

Pressure Error

JNS-1

Tube length		5'		15'			
Flight No.	Run No.	Defl.	Head H_2O	Defl.	Head H_2O	Diff. %	
1	1	.70	2.70	1.69	2.75	1.8	
	2	.80	3.25	1.87	3.30	1.6	Av. + 1.7
Tube length		5'		25'			
5	1	.94	3.92	2.07	3.91	-0.3	
	2	.96	4.02	2.09	3.99	-0.7	
	3	.93	3.87	2.05	3.86	-0.3	
	4	.97	4.07	2.12	4.07	0.0	Av. - .03
Tube length		5'		50'			
4	1	.78	3.16	1.85	3.24	2.6	
	2	.79	3.21	1.86	3.27	1.9	
	3	.81	3.31	1.90	3.40	2.7	
	4	.83	3.43	1.91	3.43	0.0	
	5	.79	3.21	1.85	3.23	1.0	Av. + 1.6

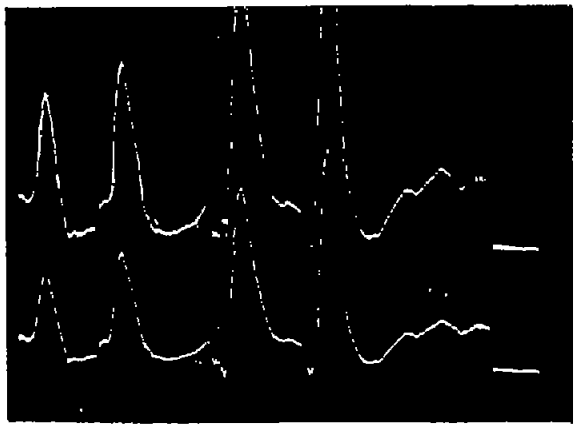
Time Error

The time error is found to be so small as to be impossible of measurement. Even in flight record No. 5, a print of which is appended, the lateral displacement of the peaks can not be detected.

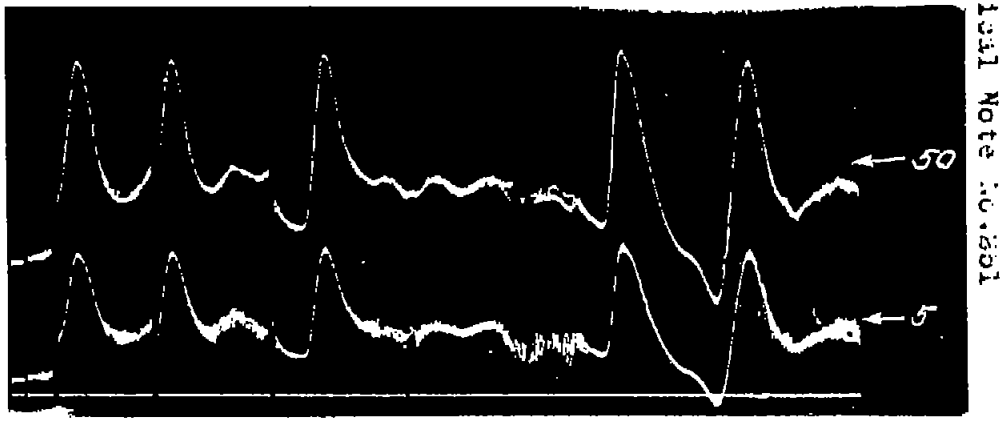
Conclusions

The differences in head caused by variations in the length of tubing are small, the lowest recorded being zero, and the highest 2.7 per cent. This difference is well within the experimental error.

Flight 1



Flight 4



Flight 5